SECTION 56

FUEL OIL STORAGE, FILL, TRANSFER AND PURIFICATION SYSTEM

56.1 REFERENCES

(56A) Code of Federal Regulations - 46 CFR Sub-chapter F

(56B) **VOLUME V**, *OWNER - FURNISHED EQUIPMENT*

56.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for the diesel oil systems needed to operate the Propulsion Diesel Engines, Ship's Service Diesel

Generators, Emergency Diesel Generator and Oil-fired Hot Water Heater. Information pertinent to the design of diesel oil tanks is also provided.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

56.3 GENERAL

Diesel oil systems shall be designed for transferring and processing ASTM D975, Grade Low Sulfur No. 2-D diesel oil. Due regard shall be given to the changes in temperature that the oil may experience during purification and through heat transfer from engine parts (i.e., clean oil return from injection system), ambient conditions and other causes.

The design pressures of on-board systems, fueling facility supply pressure, and pipe sizes shall be coordinated to suit the requirements of this Section and the flow velocity restrictions of Section 74 of the Technical Specification.

Built-in containment coamings shall be provided for all oil equipment foundations. In addition, drip pans shall be permanently installed beneath such items as strainers, filters and oil burners.

See Section 74 of the Technical Specification for general piping and material requirements and Section 75 of the Technical Specification for insulation and lagging requirements.

The Propulsion System Integration (PSI) Contractor, under the direction of the WSF Representative, will oversee and assist as the Contractor's "technical point-of-contact" (TPOC) regarding the design, integration, installation, interface of the Main Engine and AMS Systems interface with the Contractor designed fuel oil system.

The Ship's Service Diesel Generator (SSDG) Contractor, under the direction of the WSF Representative, will oversee and assist as the Contractor's "technical point-of-contact" (TPOC) regarding the design, integration, installation, interface of the SSDGs and Emergency Diesel Generator with the Contractor designed fuel oil system.

The PSI Contractor and the SSDG Contractor shall also participate in an advisory capacity in the Contractor's selection of related machinery and equipment.

56.4 TANKS

All FO tanks, except drain tanks and the Emergency Generator fuel oil tank, shall be part of the Vessel's structure (i.e. not free standing).

The aggregate volume of all storage/overflow/drain tanks shall be sufficient to hold the volume of fuel oil as set forth in Section 78 of the Technical Specification without exceeding the 95-percent (95%) full level in any tank.

56.4.1 Main Fuel Oil Storage Tanks

The design shall include two (2) Main Fuel Oil Storage Tanks.

56.4.2 Main Fuel Oil Day Tank

The design shall include one (1) Main Fuel Oil Day Tank.

56.4.3 Overflow Tank

The design shall include an overflow tank. The overflow tank shall have sufficient volume to prevent an overflow condition and allow a minimum of five (5) minutes for the operating Engineer to secure fuel transfer/fueling operations, based on a 60,000 GPH fueling rate.

56.4.4 Emergency Generator Fuel Oil Tank

A dedicated, free standing, fuel oil tank shall be provided for the Emergency Generator and sized to suit regulatory requirements.

56.4.5 Used Oil Drain Tanks

Refer to Section 70 of the Technical Specification for requirements.

56.5 FUEL OIL FILLING, OVERFLOW AND TRANSFER SYSTEMS

The fill and transfer system shall be designed to permit the following fueling operations:

A. Fill each storage tank from shore and a tanker truck via Lower Vehicle Deck fueling station.

B. Transfer from each storage, overflow and day tank to shore via Lower Vehicle Deck fueling station.

C. Transfer among all storage, day, overflow, and Emergency Generator fuel oil tanks.

D. Take a suction on any storage or day tank and re-circulate back to that same tank.

Provide and install motorized ball valves with TRIAC E-Series 24Vdc actuators, or equal, in the transfer system piping at the outlet of the Day Tank, Overflow Tank, and Storage Tanks. The motorized valves shall be remotely operable from the Engineer's Operating Station (EOS). See Section 74 for electric valve requirements.

56.5.1 Transfer Pump

Transfer operations shall be performed using a ROPER 34AM32, or equal, rotary gear pump with a nominal capacity of fifty (50) gallons per minute.

The transfer pump suction piping shall include a generously sized simplex basket strainer with fine mesh perforations.

The transfer pump discharge piping shall include a LUBERFINER, or equal, combination filter/coalescer housing equipped with a ten (10) micron rated filter.

56.5.2 Fueling/Transfer Piping

Fueling/transfer system suction and discharge valves shall be manifolded.

The transfer system piping shall be sized to limit the suction on the transfer pump to a maximum of ten (10) inches Hg vacuum when taking suction from the most distant storage tank when the tank is one-half (½) full and the fuel is at minimum ambient temperature.

Fueling shall be accomplished using shore-side pressure. The system shall be designed such that fueling of the Vessel may be accomplished within one (1) hour through one shore connection. For the purposes of this requirement, "fueling" shall mean the on-load of a quantity of diesel oil equal to 95-percent (95%) of the aggregate volume of the two (2) storage tanks.

The fueling station shall terminate in a four (4) inch cam-lock fitting and shall include a test valve for sampling the fuel and a gage to monitor fuel pressure at the station. A butterfly valve sized to the full diameter of the transfer piping shall be situated between the tees for the sample station and the pressure gage.

A full-port ball valve, sized to the full diameter of the transfer piping, shall be provided and situated adjacent to the fuel manifold to allow the Engineer to quickly secure fueling to all the tanks, without having to close an individual gate valve for each tank. A pressure gage, with isolation (root) (see Section 85 of the Technical Specification) valve shall be located between the fuel manifold ball discharge side of the fuel manifold to allow the Engineer to read fuel pressure during a fueling operation at the fuel manifold.

The normal path for fuel when fueling the Vessel from a shore side connection shall be as follows:

1. From fuel hose on the dock through kamlock fitting on the Vessel, and then through a gate valve located at the Vessel fueling station.

2. Through a ball valve located at the fuel manifold, and into the discharge header of the manifold.

3. Through the discharge header of the manifold, into a discharge gate valve for an individual tank.

4. Through the suction/discharge line, through a motor operated remote shutoff ball valve for an individual tank, and into that tank.

See the *Fueling Station Sliding Doors* Subsection in Section 4 of the Technical Specification for Fueling Station door requirements.

56.5.3 Overflow Piping

The Day fuel oil, and storage tanks shall overflow into the Overflow Tank described in the *TANKS* Subsection in this Section of the Technical Specification. An overflow condition shall be alarmed by installing both a flow switch in the common piping header to the overflow tank and a high level alarm at the 10-percent (10%) full point in the overflow tank.

Provide an overflow fuel oil piping system at each end of the storage tanks tied into the vent system. Each common overflow line into the overflow tank (one (1) in Engine Room No 1, and one (1) in Engine Room No. 2) shall be provided with an individual flow switch interfaced to the Alarm & Monitoring System. See Section 99 of the Technical Specification.

The Emergency Generator Fuel Oil Tank shall overflow directly into the Day Fuel Oil (FO) Tank described in the *TANKS* Subsection in Section 78 of the Technical Specification, at the 90-percent (90%) tank level. An overflow condition shall be indicated by the provision of a sight glass (roto-meter) installed as indicated below. Provide a flow switch, installed in the overflow from the Emergency Generator Fuel Tank at the inlet to the Day Tank to provide an input to the Alarm & Monitoring System. A “valved” cross-connection between the Emergency Generator Fuel Oil Tank drain and the Emergency Generator Fuel Oil Tank overflow shall be provided to allow the tank drain, which shall normally be drained to the Overflow Tank, to be drained to the Day FO Tank as desired by the Vessel staff.

The Emergency Generator fuel oil tank shall include a GEMS SURESITE, or equal, level indicator visible by the Engineer at the tank. In addition, an in-line sight glass (roto-meter) shall be provided in the overflow outlet back to the day tank at the purifier visible to the Engineer.

A flow switch installed in each Overflow Tank inlet pipe shall provide an alarm at the EOS and the tank fill (pumping) station when an overflow conditions exists.

56.6 FUEL OIL PURIFICATION SYSTEM

A fuel oil purification system shall be provided to remove water and more dense contaminants from oil being circulated between the storage tanks and day tank.

The system shall:

A. Incorporate one (1) centrifugal purifier.

B. Circulate oil from either storage tank(s) or day tank through the purifying unit and back to the respective storage tank or to the day tank. The intent is that the system will circulate from any one (1) tank to any other tank.

C. Drain waste and/or water from the purifier's sludge tank to the Used Oil Holding Tank as described in Section 70 of the Technical Specification.

D. Provide for the FO transfer pump, together with the combination coalescer/filter, to be utilized as a backup source of purifying the fuel oil.

E. Provide for the connection of an OFE portable ALFA LAVAL Model MIB 303 "Emmie" mobile oil cleaning system to be connected in parallel with the stationary purifier.

The purifying unit shall be an ALFA-LAVAL MIB 303 Series, or equal, manual-cleaning, centrifugal purifier with features as recommended by ALFA-LAVAL. Each shall be supplied with a feed pump sized for the particular unit. The minimum design flow rate through the purifying unit shall be at least equal to the combined maximum fuel consumption rate of all diesel engines and the Oil-fired Hot Water Heater. The purifying unit shall be capable of continuous operation at the rated capacity. The purifying unit shall be equipped with alarms which interface with the AMS, instrumentation, safety shutdowns and controls for local operation and remote monitoring at the EOS Control Console. Remote emergency shutdown controls shall be provided at the EOS Control Console and elsewhere as required by Authoritative Agencies.

The purifier skid assembly, mounting and arrangement shall be suitable for operation, maintenance and inspections. The purifier shall be mounted approximately thirty (30) inches above the deck (at a deck level approximately nine (9) foot ABL) in Engine Room No. 2 for easy cleaning and maintenance. Provide a purifier workbench/tool board as set forth in the *CENTRIFUGAL FUEL OIL PURIFIER WORK STATION* Subsection in Section 80 of the Technical Specification. The workbench shall be located adjacent to the purifier, as a station for cleaning, disassembly, and assembly of the purifier. The purifier, fuel oil transfer pump, combination filter/coalescer, and fuel oil manifold shall be located in close proximity to each other to allow for easy monitoring, operation, and maintenance. The purifier feed pump shall be located on a platform twelve (12) inches in elevation above the bottom of the storage tanks.

Provide quick disconnect fittings with isolation ball valves on the suction side of the purifier feed pump, and on the discharge side of the purifier bowl to allow for quick temporary installation of an OFE portable ALFA LAVAL Model MIB 303 "Emmie" mobile hydraulic cleaning system, for use in the event of failure of the stationary purifier. The quick disconnect fittings provided shall mate with the ALFA LAVAL attached fittings as supplied on the mobile MIB 303.

56.7 FUEL OIL SERVICE SYSTEM

The diesel oil service system shall consist of one (1) day tank, one (1) Emergency Generator fuel oil tank, and the supply/return piping serving the two (2) Main Engines, three (3) Ship's Service Diesel Generators, one (1) Emergency Diesel Generator, and one (1) Oil-fired Hot Water Heater. Provide fuel oil supply and return piping ball valves, readily accessible at each engine and the Oil-fired Hot Water Heater, for material and isolation capabilities as set forth in Section 74 of the Technical Specification. See Reference (56B) for specific components furnished as Owner - Furnished Equipment (OFE).

The service system shall be arranged to permit the Main Engines, Ship's Service Diesel Generators and the Oil-fired Hot Water Heater to be supplied by the day tank via a separate fuel supply header located at the tank outlet in each Engine Room.

Diesel oil service return piping to the day tank and Emergency Generator fuel oil tank shall terminate within the tanks in a manner that minimizes fuel aeration. Fill piping inside the tank shall be designed to prevent back siphoning of the tank contents back through the fill piping.

The fuel oil supply system in each Engine Room shall be able to be secured remotely from the EOS by the installation of motorized, TRIAC E-Series, 24 Vdc electric actuators, or equal, ball valves, located at the tank outlet supply to the fuel supply headers. The intent is to be able to secure the fuel in one (1) Engine Room without affecting operations in the other Engine Room.

56.7.1 Main Engine

The supply piping serving each Main Engine shall include the OFE dedicated full flow, two (2) micron, coalescing triplex filter assembly in addition to the OFE engine-mounted duplex filter. Each filter assembly shall be provided with a stainless steel drip pan and differential pressure gage. The fuel return lines shall be sized so as not to exceed seven (7) psi of back pressure.

NOTE: The Main Engines shall be resiliently mounted and shall be provided with flexible hose connections to the fuel supply and return lines. These hoses and fittings shall be standardized to the greatest extent practicable with the hoses utilized in other areas of the fuel and other oil systems.

56.7.2 Ship's Service and Emergency Diesel Generators

In addition to the OFE engine mounted filter on each diesel, the Contractor shall provide on the supply piping serving the Ship's Service Diesel Generators and Emergency Diesel Generator, dedicated, 30-micron, duplex filter assemblies, with one (1) assembly serving each diesel generator set. For WSF Fleet-wide Standardization purposes these filters shall be RACOR Model 75/1000 MAXN Turbine Series with metal bowls. These filters shall be located in close proximity to each Ship's Service Diesel Generator Set, and allow ample room for maintenance and filter change outs. Each filter assembly shall be provided with a stainless steel drip pan and differential pressure gage.

NOTE: The Ship's Service Diesel Generators and the Emergency Diesel Generator shall be resiliently mounted and shall be provided with flexible hose connections to the fuel supply and return lines. These hoses and fittings shall be standardized to the greatest extent practicable with the hoses utilized in other areas of the fuel and other oil systems.

56.7.3 Oil-fired Hot Water Heater

The supply piping serving the Oil-fired Hot Water Heater shall include a Contractor provided 10-micron spin-on duplex filter assembly. The filter assembly shall be provided with a stainless steel drip pan and differential pressure gage.

56.8 CLEANING AND FLUSHING

NOTE: Fuel oil cleaning and flushing procedures shall meet the requirement of all equipment manufacturers and Section 74 of the Technical Specification. Where a conflict arises between these requirements and the procedures outlined below, the Contractor and WSF shall mutually agree upon deviations from the outlined procedures.

Thoroughly clean all fuel oil system piping material, including fittings, after fabrication or assembly, and before installation, by pickling in hot acid.

Thoroughly rinse after the acid bath, acid neutralize, rinse again, dry and immediately coat with a preservative oil. Cover all open ends with bolt on caps or screw in/on plugs until the piping material is installed.

After installation has been completed, bypass the pumps and piping components that might be damaged or plugged by debris in each individual fuel oil system.

Thoroughly clean and flush the piping systems by continuously circulating fuel oil at a velocity of at least twenty-five (25) FPS through a temporary five (5) micron strainer and filter system, fitted with muslin bags and magnets, until filters remain clean for two (2) consecutive two-hour runs at full flow operation. As an alternative, the Contractor may use a

duplex strainer fitted with muslin bags and magnets. Cleanliness criteria shall be no appreciable contamination for period of two (2) hours, until filters remain clean for two (2) consecutive two-hour runs at full flow operation. Flushing shall be accomplished utilizing pumping devices that do not form a part of any piping system permanently installed in the Vessel.

Pneumatic or electric motor driven line vibrators, of the temporary in-line and/or portable hand types, shall be continuously employed during the cleaning process. The vibrators shall be firmly affixed to the piping throughout the cleaning cycle.

When a satisfactory level of cleanliness has been attained, remove the flushing oil from the system paying particular attention to draining low points. Dispose of the used flushing oil and contaminated filters in accordance with current rules, regulations, and laws of cognizant agencies.

Remove all temporary filters and replace all permanent filter elements with new elements of the appropriate type. Provide a tag on each filter housing which indicates the date the filter was installed and by whom.

Open and manually clean affected sumps and tanks with lint-free rags or other suitable wiping material to remove all traces of residual contamination and oil. Final inspection of oil sumps and closure of accesses is to be witnessed by the WSF Representative. Close the sumps and tanks utilizing new gaskets and corrosion resistant nuts and studs/bolts.

56.9 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools, for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

56.10 TESTS, TRIALS AND INSPECTIONS

Tests and/or trials shall be provided in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and Section 1 of the Technical Specification of the Technical Specification.

56.11 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical

Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations - Fuel Oil Fill, Overflow, and Transfer Service System

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

56.12 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations - Fuel Oil Fill, Overflow, and Transfer Service System

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

(END OF SECTION)